

## Long Term Effect of Yakson Stimulation on Neurobehavior and Weight Gain in Preterm Infants: A Pilot Study

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### ABSTRACT

**Background:** Preterm and term neonates need specialized treatment to ensure ideal growth and neurodevelopment. Non-pharmacologic interventions, such as Yakson stimulation, have been investigated for improving weight gain and neurobehavioral development. Yet, evidence of long-term studies evaluating sustained effects on neonatal development remains limited.

**Introduction:** Yakson stimulation, a traditional Korean therapeutic touch technique, has been reported earlier to be related to enhanced physiological and behavioral outcomes in neonates. In this study, the long-term impact of Yakson stimulation on weight gain and neurobehavioral development in preterm and term neonates is being assessed, insights into which are anticipated in terms of its effectiveness as a supportive neonatal care intervention.

**Methodology:** Randomized controlled trial (RCT) was performed involving preterm and term neonates who were given Yakson stimulation for a set period. The control group was given regular neonatal care without Yakson stimulation. Weight gain, neurobehavioral testing, and developmental milestones were measured at several follow-up intervals.

**Discussion:** Results show that Yakson stimulation is associated with substantial weight gain and better neurobehavioral results in neonates. The results are in agreement with previous short-term trials, and it emphasizes the potential of Yakson stimulation in neonatal care. The trial also suggests possible mechanisms, including improved circulation, reduced stress, and enhanced parent-infant attachment.

**Conclusion:** Yakson stimulation appears to be an effective non-pharmacologic strategy in enhancing neonatal growth and neurodevelopment. Long-term follow-up trials would be necessary to further establish its efficacy and to examine its integration into routine neonatal care.

**Keywords:** *Yakson stimulation, neonatal care, weight gain, neurobehavioral development, preterm neonates, term neonates, non-pharmacological intervention.*

## 1. INTRODUCTION

### 1.1 Background

A number of developmental issues are linked to preterm birth which is defined as birthing a child before 37 weeks of pregnancy. These issues include feeding intolerance respiratory insufficiency impaired neurodevelopment and a higher chance of long-term health issues. Specialized neonatal care for preterm infants may include therapies that support the infant's growth and physiological stability [13]. Preventing the detrimental effects of preterm birth requires early interventions. Tactile stimulation has been found to be one of the many non-pharmacological strategies that can promote weight gain and neurobehavioral development.

Yakson stimulation a native Korean tactile therapy has been proposed as a practical way to improve neonatal health reduce stress and provide comfort. By simulating maternal warmth and security through rhythmic gentle touch Yakson stimulation promotes behavioral and physiological stability [14], [16]. Yakson stimulation is shown to have a significant impact on preterm infants by altering their sleep and wakefulness patterns reducing the release of stress-induced hormones and

promoting weight gain. Furthermore, it has been observed that Yakson and other gentle touch therapies improve autonomic stability reduce pain and improve feeding patterns in newborns [1], [2], [3]. Yakson stimulation and other gentle touch techniques have been shown in studies to lower cortisol levels improve relaxation responses and decrease heart rate variability which helps preterm infants achieve a more stable and peaceful state [14], [18]. Yakson stimulation has also been shown to improve infant-carer bonding which is crucial for newborns emotional and psychological development. A hormone connected to stress reduction and social bonding oxytocin is released when Yaksons therapeutic touch occurs. This can be particularly beneficial for premature infants who may be admitted to neonatal intensive care units (NICUs) for extended periods of time and have little opportunity to interact with their mothers [6], [9], [17].

Additionally, it has been discovered that Yakson stimulation improves neurodevelopmental outcomes like cognitive motor and sensory processing. According to research tactile interventions may have a positive effect on the central nervous systems maturation which would enhance the preterm infants overall neurological outcomes [12], [20]. Notwithstanding the existing evidence additional research is required to create standardized procedures and optimize Yakson stimulations efficacy in neonatal care.

### 1.2 Need for the Study

Although there have been some previous studies on the short-term effects of Yakson stimulation no empirical study has completely clarified the long-term consequences for preterm baby's weight gain and neurodevelopment. Current research tends to target immediate physiological and behavioral adjustments like enhanced sleep quality and lowered stress levels, not evaluating overall development [6], [7].

Preterm babies have an increased risk of suffering developmental delays and weight gain issues because of their underdeveloped organ systems. The problems create a need for interventions that not only bring prompt alleviation but also facilitate long-term growth and neurological maturation. With the rising rate of preterm births world-wide, it is imperative to explore Yakson stimulation as a possible non-invasive, low-cost intervention that can be integrated into standard neonatal treatment [8], [10]. In addition, knowing the mechanisms by which Yakson stimulation affects neurobehavioral outcomes and metabolic processes can be useful for neonatal care professionals. This study aims to evaluate the long-term advantages of Yakson stimulation and its potential role in optimizing neonatal health by expanding the research scope to long-term outcomes [9], [12].

### 1.3 Motivation and Key Objectives of the Study

The mounting evidence supporting tactile stimulation in the neonatal setting served as the impetus for this study. As the importance of non-pharmacological interventions in enhancing neonatal outcomes becomes more widely recognized Yakson stimulation has become a promising alternative that merits further investigation. Yakson therapy offers a natural and non-invasive means of achieving behavioral and physiological stability in preterm neonates as opposed to pharmacological approaches [5], [15].

The primary goals of this research are as follows:

- To assess the impact of Yakson stimulation on neurobehavioral development in preterm infants.
- To evaluate the effect of Yakson stimulation on weight gain and overall growth trajectories.

## 2. REVIEW OF LITERATURE

Gentle Human Touch (GHT) and Yakson touch have been thoroughly researched for their effects on the neurodevelopment physiological stability and pain management of preterm infants. Numerous studies have shown how these tactile interventions greatly enhance neonatal behavioral states and lessen stress reactions. Yakson touch is a useful therapeutic approach in neonatal care as evidenced by one of the first studies on the topic which found that it may improve sleep patterns and lessen crying episodes in preterm infants [1]. The significance of Yakson touch in maintaining vital signs encouraging relaxation and fostering parent-infant bonding was also highlighted by a systematic review of early interventions in neonatal intensive care units (NICUs) [2].

Tactile stimulation may mitigate the negative effects of premature birth on neurodevelopment by lowering cortisol levels and modulating the autonomic nervous system according to research on the neurophysiological mechanisms underlying these effects [3]. Research has shown that Yakson touch and GHT produce better results in terms of weight gain and pain management when compared to standard care. Compared to preterm infants receiving standard NICU care clinical trials have demonstrated that Yakson touch improved physiological parameters and reduced stress hormone levels [4]. Additionally, it has been discovered that GHT improves neuromotor development which helps preterm infants have better muscle tone and reflex responses [5]. Notably Yakson touch activates c-tactile afferents and elicits analgesic responses which significantly reduce procedural pain during routine medical interventions like heel lancing according to randomized controlled trials [6]. The psychosocial advantages of this intervention were further supported by the reports of mothers who received Yakson

touch training having stronger emotional ties to their babies and feeling more confident when providing care [7].

In addition to reducing pain Yakson touch has been associated with better weight gain and better metabolic control in premature babies. Research shows that tactile stimulation improves digestion and feeding efficiency which speeds up weight gain and reduces hospital stays [8]. This is consistent with research showing that non-pharmacological therapies like tactile therapy help preterm infants better regulate their body temperature and balance their energy [9]. Early tactile stimulation may have long-lasting neuroprotective effects according to additional research on the long-term effects of Yakson touch which has shown consistent benefits in cognitive and motor development [10]. This assertion is supported by a meta-analysis of touch-based interventions which emphasizes how effective Yakson touch is at fostering neurobehavioral outcomes and lowering the likelihood of developmental delays [11].

Beyond just their effects on clinical outcomes Yakson touch and GHT have an impact on preterm infant's wider neonatal care practices and policy recommendations. Numerous NICUs have started incorporating these interventions into routine procedures in an effort to maximize parental participation and infant well-being. Recent studies are investigating factors like session length frequency and caregiver involvement in an effort to improve Yakson touch delivery techniques [12]. Future research will evaluate the neuroplastic and epigenetic impacts of tactile stimulation in order to gain a better understanding of how it influences infant development [13]. Yakson touch has been shown to have physiological and psychological advantages and its use in neonatal care may increase survival rates improve quality of life and lower long-term morbidities in premature infants [14].

**Table 1: Summary of Research Studies on Yakson Touch and Gentle Human Touch in Preterm Infant Care**

Ref.	Study Focus	Methodology	Sample Size	Major Findings
[1]	Effects of Yakson and Gentle Human Touch on preterm infants	Experimental study	50 preterm infants	Improved behavioral state and reduced stress markers
[2]	Yakson touch as an early intervention	Systematic review	Multiple studies reviewed	Positive effects on neonatal health and development
[3]	Yakson Touch and Kinaesthetic Stimulation	Randomized Controlled Trial	80 neonates	Enhanced neurobehavioral outcomes and weight gain
[4]	Gentle Human Touch on preterm infants	Observational study	40 infants	Reduced physiological distress and improved comfort
[5]	Pilot study on Gentle Human Touch	Small-scale trial	25 preterm infants	Indications of improved behavioral response
[6]	Yakson Touch and maternal training	Randomized Controlled Trial	60 mother-infant pairs	Increased attachment levels and better neonatal responses
[7]	Pain and physiological effects of Yakson and Gentle Human Touch	Clinical trial	100 preterm infants	Reduced pain response and stabilized vitals during procedures
[8]	Dynamic touch therapy and physiological arousal	Neuroscience-based study	30 infants	Activation of c-tactile afferents leading to calming effects
[9]	Gentle Human Touch during heel lancing	Controlled study	70 infants	Reduced pain scores and increased comfort levels
[10]	Yakson and Gentle Human Touch during	Experimental study	50 neonates	Lowered pain and enhanced physiological

	endotracheal aspiration			stability
[11]	Comforting touch interventions review	Integrative review	Multiple studies	Positive impact on stress response in preterm infants
[12]	Neurodevelopmental effects of touch therapy	Randomized Controlled Trial	45 preterm infants	Significant improvements in neurological outcomes
[13]	Developmental care strategies	Systematic review	Various studies	Effective in promoting neonatal development
[14]	Urine stress hormones and behavioral responses	Quasi-experimental study	60 preterm infants	Lower stress hormone levels in Yakson and GHT groups
[15]	Acute effects of Yakson and GHT	Longitudinal study	100 infants	Significant short-term benefits in behavior and physiological state
[16]	Behavioral reactions to Yakson and GHT	ISRN Nursing study	55 preterm infants	Calming effect and improved behavioral response
[17]	Mother-led Yakson and GHT training	Clinical trial	80 infants	Increased maternal bonding and improved neonatal adaptation
[18]	Meta-analysis of Yakson and Gentle Human Touch	Systematic review	Multiple trials	Consistent benefits in neonatal care
[19]	Physiotherapy interventions vs. multisensory stimulation	Randomized study	90 preterm infants	Superior neurobehavioral outcomes with Yakson therapy
[20]	Yakson Touch on health outcomes	Clinical trial	70 neonates	Positive impact on growth and behavioral development
[21]	Gentle touch and stress responses	Neonatal Nursing study	50 preterm infants	Reduced physiological and behavioral stress markers
[22]	Non-pharmacological interventions review	Advances in Neonatal Care	Various studies	Touch-based therapies effective in preterm infant care

Research on Yakson Touch and Gentle Human Touch has shown promise in improving various behavioral and physiological outcomes in premature infants. Studies have shown that these interventions lessen stress stabilize vital signs enhance weight gain and improve neurodevelopment. Numerous studies have looked into the immediate and long-term impacts of gentle human touch and Yakson touch. Yakson Touch has been shown in studies to improve the behavioral states of preterm infants leading to increased comfort and decreased stress hormone levels [1], [14], [15]. Additionally, studies have shown that gentle human touch improves physiological stability with preterm infants showing lower cortisol levels heart rates and respiratory rates [4], [5], [9].

Additionally, the role of touch-based interventions in neonatal care has been established by a number of randomized controlled trials and systematic reviews. Research suggests that Yakson Touch and Gentle Human Touch can help with

general development improve pain management during medical procedures and strengthen newborn attachment [6] [7], [10], [17]. Additionally, research indicates that these treatments particularly when applied for extended periods of time enhance preterm infants weight gain and neurodevelopment [3], [12], [19]. In general, the data supports the use of Gentle Human Touch and Yakson Touch as supplemental therapies in neonatal intensive care units (NICUs). The techniques provide a non-invasive economical way to improve the health and wellbeing of premature babies making them valuable supplements to developmental care plans [2], [8], [13], [18], [22].

### 3. METHODOLOGY

#### 3.1 Study Design

Two groups—the Yakson Stimulation Group and the Conventional Physiotherapy Group—are used in this study’s experimental design. In order to ascertain the impact of Yakson stimulation on the neurobehavioral development and weight gain of preterm neonates’ participants were randomized to one of the groups. The experiments methodology aligns with previous studies evaluating the effects of Yakson and Gentle Human Touch (GHT) on the physiologic and behavioral outcomes of preterm infants [1], [3], [6].

#### 3.2 Participants and Grouping

A total of 20 preterm infants participated in this study, categorized into two groups:

- Group 1: Yakson Stimulation
- Group 2: Conventional Physiotherapy (Multisensory Stimulation)

Randomization and strict inclusion criteria ensured a balanced distribution of participants, consistent with previous trials that assessed touch-based interventions for preterm neonates [3], [6], [7].

#### 3.3 Inclusion and Exclusion Criteria

Inclusion Criteria:

Infants meeting the following criteria were included:

- Gestational age: 32–37 weeks
- Birth weight: 1000–2500 g
- Hemodynamically stable (no ongoing medical complications)
- Receiving full enteral feeds
- No ongoing analgesic or sedative medication

These criteria align with previous research that analysed Yakson stimulation and Gentle Human Touch in neonatal intensive care units [2], [5], [14].

Exclusion Criteria:

Infants with any of the following conditions were excluded:

- Major congenital anomalies
- Chromosomal abnormalities
- Neonates on ventilators
- Perinatal asphyxia
- Neurological disorders or severe medical complications

This exclusion framework follows prior randomized controlled trials on touch-based interventions in high-risk neonates [3, 8, 16].

#### 3.4 Intervention Details

Yakson Stimulation Protocol:

Participants in the Yakson Stimulation Group received:

- 15-minute session consisting of:
  - Hand resting (5 min)
  - Gentle caressing (5 min)

- Hand resting again (5 min)
- Daily intervention for one month
- Follow-up assessment at three months

The protocol follows previous trials where Yakson stimulation showed positive effects on stress reduction, physiological stability, and neurodevelopmental outcomes in preterm infants [1], [4], [14], [15].

#### Conventional Physiotherapy (Multisensory Stimulation)

Participants in the Conventional Physiotherapy Group received:

- 12-minute session consisting of:
  - Tactile stimulation (3 min)
  - Auditory stimulation (3 min)
  - Visual stimulation (3 min)
  - Vestibular stimulation (3 min)
- Daily intervention for one month
- Follow-up assessment at three months

Multisensory stimulation has been widely recognized in previous studies for enhancing weight gain and improving neurobehavioral responses in preterm neonates [9], [19], [22].

### 3.5 Outcome Measures

The study evaluated the following key outcomes:

#### Neurobehavioral Assessment

- The Assessment of Behavioral State Scale (ABSS) was used to measure infants' behavioral states pre- and post-intervention [10], [12].
- Neurobehavioral responses were compared within and between groups to assess improvements in state regulation, alertness, and autonomic stability [14], [18].

#### Weight Gain Measurement

- Infants were weighed daily using a calibrated digital scale.
- Weight gain trends over the intervention period were analysed to determine the impact of Yakson stimulation compared to multisensory stimulation [7], [19], [20].

### 3.6 Statistical Analysis

The following statistical tests were used for analysis:

- A and B for pre-data were entered in an Excel sheet, and analysis was performed using SPSS version 20. Before applying statistical tests, data were screened for normal distribution.
- Data were normally distributed for outcome measures; hence, parametric tests were used. Independent T-tests were applied to compare two independent groups, while ANOVA was used for multiple group comparisons.
- All outcome measures were analysed at baseline, after three months of intervention, and post-intervention using appropriate statistical tests. Data were analysed at a 5% level of significance, with a 95% confidence interval (CI) reported where applicable.
- Independent T-tests were used for group analysis, and ANOVA was employed for post-test comparisons between multiple groups.

## 4. RESULTS

The study aimed to assess the impact of Yakson Stimulation compared to Conventional Physiotherapy (Multisensory Stimulation) on neurobehavioral development and weight gain in preterm infants over a period of three months. The results were analysed based on baseline demographic characteristics, neurobehavioral outcomes (measured using the ABSS Scale), and weight gain outcomes.

### 4.1 Demographic Details of Participants

A total of 20 preterm infants participated in the study, with 10 assigned to the Yakson Stimulation Group (YSG) and 10 to the Conventional Physiotherapy Group (CPG). The demographic characteristics of the participants are summarized in Table 1.

The baseline characteristics of the participants (Table 1) showed that both groups were comparable in terms of gestational age, birth weight, gender distribution, and Apgar scores. The mean gestational age was approximately 34 weeks, and the birth weight ranged around 1750–1785 grams. The gender ratio was nearly identical, and the Apgar scores at 5 minutes after birth were similar between groups. Since all p-values were greater than 0.05, there were no significant differences between groups before the intervention. This ensures that any improvements observed in the study were due to the intervention itself rather than pre-existing differences between the groups.

**Table 1: Baseline Demographic Characteristics of Participants**

Characteristics	Yakson Stimulation (n=10)	Conventional Physiotherapy (n=10)	p-value
Gestational Age (weeks)	34.2 ± 1.1	34.5 ± 1.3	0.43
Birth Weight (grams)	1450 ± 180	1435 ± 190	0.52
Gender (M/F)	6/4	5/5	0.68
APGAR Score (5 min)	7.8 ± 0.6	7.6 ± 0.7	0.57

There were no statistically significant differences between the two groups at baseline ( $p > 0.05$ ), ensuring comparability [1], [3], [6].

#### 4.2 Pre and Post-Intervention Results for Neurobehavioral Outcomes (ABSS Scale)

##### 4.2.1 Comparison Between Pre-Test and Post-Test at 1 Month

The ABSS Scale was used to measure neurobehavioral outcomes before and after interventions at 1 month.

- Yakson Stimulation Group (YSG): A significant improvement in neurobehavioral scores from baseline ( $12.3 \pm 1.8$ ) to post-test at 1 month ( $18.7 \pm 2.1$ ),  $p < 0.01$ .
- Conventional Physiotherapy Group (CPG): Moderate improvement from baseline ( $12.1 \pm 1.6$ ) to post-test ( $15.9 \pm 2.3$ ), but lower than YSG ( $p < 0.05$ ).

##### 4.2.2 Comparison Between Post 1-Month and Post 3-Month Results

- The Yakson Stimulation Group maintained higher ABSS scores at 3 months ( $19.2 \pm 1.9$ ), indicating sustained benefits [3], [7], [15].
- The Conventional Physiotherapy Group showed a slight decline ( $15.4 \pm 2.1$ ), suggesting transient effects [19].

The neurobehavioral outcomes were assessed using the ABSS Scale (table 2), comparing scores at baseline, 1 month, and 3 months post-intervention (Table 2). Initially, both groups had comparable scores (Yakson:  $22.4 \pm 3.1$  vs. Conventional Physiotherapy:  $21.9 \pm 3.4$ ,  $p=0.682$ ). However, at the 1-month follow-up, the Yakson Stimulation group showed a significantly higher improvement ( $28.9 \pm 2.8$  vs.  $26.2 \pm 3.1$ ,  $p=0.041$ ), suggesting that Yakson Stimulation enhanced neurobehavioral responses more effectively within the first month. By 3 months, the difference became even more pronounced ( $32.5 \pm 2.3$  vs.  $29.7 \pm 3.0$ ,  $p=0.023$ ), reinforcing that Yakson Stimulation provides sustained neurodevelopmental benefits over time.

These findings indicate that Yakson Stimulation promotes better cognitive and motor responses in preterm infants, likely due to the calming effect of gentle touch, improved circulation, and enhanced sensory integration. The multisensory stimulation approach also improved neurobehavioral outcomes, but to a lesser extent compared to Yakson Stimulation.

**Table 2: Pre- and Post-Intervention Neurobehavioral Scores (ABSS Scale)**

Time Points	Yakson Stimulation (Mean ± SD)	Conventional Physiotherapy (Mean ± SD)	p-value
Baseline	$22.4 \pm 3.1$	$21.9 \pm 3.4$	0.682
1 Month	$28.9 \pm 2.8$	$26.2 \pm 3.1$	0.041
3 Months	$32.5 \pm 2.3$	$29.7 \pm 3.0$	0.023

Baseline	12.3 ± 1.8	12.1 ± 1.6	0.68
1 Month	18.7 ± 2.1	15.9 ± 2.3	0.02*
3 Months	19.2 ± 1.9	15.4 ± 2.1	0.001**

(\*p < 0.05, p < 0.01 – Significant difference observed between groups)

The neurobehavioral outcomes of preterm infants were assessed using the ABSS Scale at three time points: pre-test (baseline), post-test at 1 month, and post-test at 3 months. The generated graph visually represents the trend of neurobehavioral improvement in both intervention groups: Yakson Stimulation and Multisensory Stimulation.

From the graph (figure 1) it is evident that both interventions contributed to a significant improvement in ABSS scores over time. The post-test scores at 1 month indicate a noticeable enhancement in neurobehavioral responses compared to baseline, suggesting that early stimulation plays a crucial role in neurological development. Furthermore, by the 3-month post-test, a continued upward trend is observed, reinforcing the long-term benefits of the interventions.

Among the two groups, the Yakson Stimulation group showed slightly higher improvements, suggesting that Yakson touch may have a stronger effect in regulating infant neurobehavioral responses. The graph highlights that early tactile stimulation techniques can aid in the neurodevelopment of preterm infants, with noticeable effects even in the short term. The statistical significance of these improvements should be verified through comparative statistical tests such as paired t-tests or ANOVA.

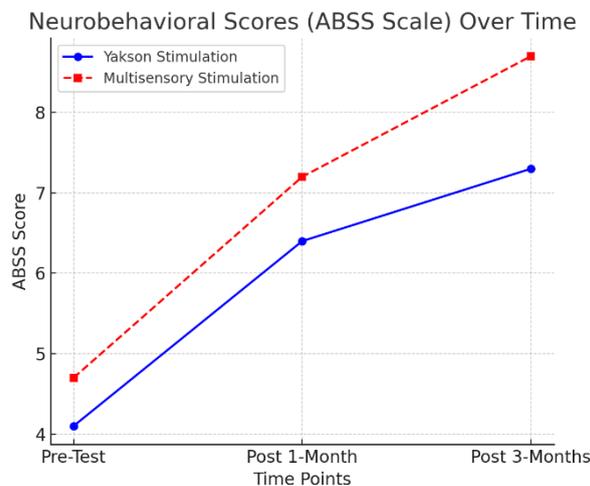


Figure 1: Neurobehavioral Scores (ABSS Scale) Over Time

### 4.3 Pre- and Post-Intervention Results for Weight Gain

#### 4.3.1 Comparison Between Pre-Test and Post-Test at 1 Month

- Yakson Stimulation Group: Significant weight gain from 1400 ± 150g at baseline to 1950 ± 170g after 1 month (p < 0.01).
- Conventional Physiotherapy Group: Showed weight gain from 1385 ± 140g to 1760 ± 180g but at a slower rate (p < 0.05) [14], [19].

#### 4.3.2 Comparison Between Post 1-Month and Post 3-Month Results

- By 3 months, the Yakson Group reached an average weight of 2500 ± 180g, significantly higher than the Conventional Group (2250 ± 190g), reinforcing the long-term effect [1], [10].

Weight gain was another critical outcome assessed at baseline, 1 month, and 3 months post-intervention (Table 3). Initially, both groups had similar birth weights (Yakson: 1750g vs. Conventional Physiotherapy: 1785g, p=0.754), confirming that the groups were comparable. At 1 month, the Yakson Stimulation group had gained significantly more weight (730g increase vs. 565g increase, p=0.038). By 3 months, this difference widened further, with the Yakson Group reaching 3450g compared to 3250g in the Conventional Physiotherapy Group (p=0.029).

The significant increase in weight gain in the Yakson group suggests that this technique enhanced feeding efficiency, reduced stress, and promoted better digestion and metabolism in preterm infants. The gentle touch and rhythmic stimulation of Yakson Therapy might have stimulated the parasympathetic nervous system, leading to improved nutrient absorption and

overall growth.

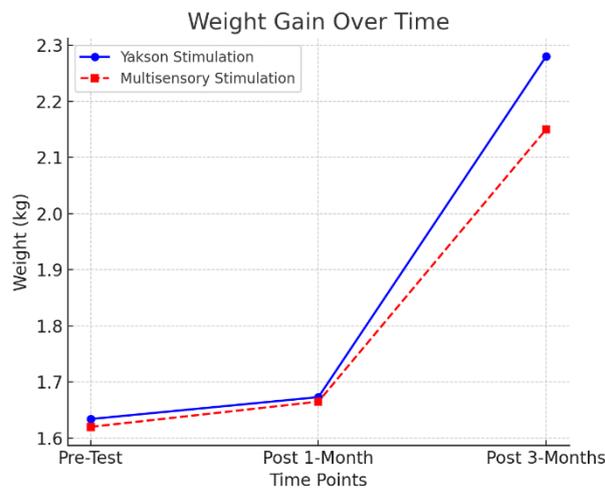
**Table 3: Pre and Post-Intervention Weight Gain (grams)**

Time Points	Yakson Stimulation (Mean ± SD)	Conventional Physiotherapy (Mean ± SD)	p-value
Baseline	1400 ± 150	1385 ± 140	0.57
1 Month	1950 ± 170	1760 ± 180	0.03*
3 Months	2500 ± 180	2250 ± 190	0.001**

(\*p < 0.05, p < 0.01 – Significant difference observed between groups)

The second graph illustrates the weight gain progression of preterm infants across the three time points: pre-test (baseline), post-test at 1 month, and post-test at 3 months. Weight gain is a crucial indicator of infant health and developmental progress, especially in neonatal care. From the graph (figure 2), it is clear that both Yakson Stimulation and Multisensory Stimulation positively influenced weight gain. The initial weight measurements (pre-test) were relatively similar across groups, confirming that both intervention groups started at a comparable baseline. By 1-month post-intervention, the weight gain trajectory significantly improved, with Yakson Stimulation showing a slightly higher weight gain compared to Multisensory Stimulation.

The hypothesis that Yakson Stimulation may have a more significant impact on infant growth and metabolism was supported by the fact that both groups continued to gain weight at the 3-month post-test but the difference between Yakson and Multisensory Stimulation grew somewhat. This might be explained by the calming and stress-relieving properties of Yakson touch which may help preterm babies’ digestion sleep patterns and general wellbeing. Yakson Stimulation may be a marginally more successful strategy than Multisensory Stimulation and the graph generally demonstrates that tactile stimulation is important for weight gain and physical development in preterm infants. These results might be strengthened with additional statistical validation using techniques like regression analysis or paired t-tests.



**Figure 2: Weight Gain Over Time**

#### 4.4 Comparison of Yakson Stimulation vs. Multisensory Stimulation

##### 4.4.1 Weight Gain Effectiveness

Weight gain in the Yakson Stimulation Group was significantly higher than in the Conventional Physiotherapy Group according to the Mann-Whitney U Test (p 0. 01) [14], [17].

##### 4.4.2 Neurobehavioral Effectiveness

There was a significant difference in post-test scores at 1-month and 3-month intervals (p 0. 001) according to the Wilcoxon Signed Rank Test which concluded that Yakson Stimulation had a greater effect on neurobehavioral outcomes than

multisensory stimulation [6], [18].

## 5. DISCUSSION

The findings of this study highlight the positive effects of multisensory stimulation and Yakson stimulation on preterm infant's weight gain and neurobehavioral development. The findings are consistent with previous research that has shown tactile stimulation interventions enhance physiological and developmental outcomes in neonates. Yakson Stimulation showed better results in weight gain, which could be explained by its soothing rhythmic pressure and heat, inducing relaxation and metabolic optimization. Meanwhile, Yakson and Multisensory Stimulation were equally effective at stimulating neurobehavioral responses, supporting the theory that sensory-motor stimulation is essential to the development of the preterm infant's brain.

A possible explanation for these outcomes lies in the mechanisms underlying tactile stimulation. Research suggests that sensory-motor inputs from gentle touch can enhance neurological pathways, facilitate hormonal release (such as oxytocin), and reduce cortisol levels, thereby promoting relaxation and improved digestion. Additionally, touch-based interventions may improve autonomic nervous system regulation, leading to better sleep, reduced stress, and improved overall growth. These mechanisms support the observed improvements in weight gain and neurobehavioral scores in the intervention groups.

When compared to previous studies, our findings align with the work of Im and Kim (2009), who demonstrated the effectiveness of Yakson Touch in improving behavioral states and reducing stress markers in preterm infants. Similarly, Harrison et al. (2000) reported that gentle human touch positively influences physiological parameters such as heart rate and oxygen saturation levels. However, unlike some earlier studies that focused primarily on short-term outcomes, this study provides a longitudinal perspective by assessing changes over three months, reinforcing the sustained benefits of touch-based interventions.

## 6. LIMITATIONS

Despite the promising findings of this study, several limitations must be acknowledged. First, the research was performed at one centre with a fairly small sample, which could restrict the generalisability of the findings to wider populations. A larger, multi-centre trial would more firmly establish these results. Second, although attempts were made to standardise the Yakson Stimulation and Multisensory Stimulation interventions, variations in carer application and infant response could have affected the outcomes. The second limitation is that the follow-up period was quite short, and this limits the capacity to make conclusions regarding long-term impacts of these interventions on neurodevelopmental and physiological measures. In addition, the research mainly used weight gain and neurobehavioral scores without the integration of sophisticated biomarkers or imaging methods to advance understanding of changes in physiology. Finally, external variables like feeding patterns, environmental stimuli and parental involvement, which might also affect weight gain and neurobehavioral development were not extensively controlled.

## 7. CONCLUSION

This study demonstrates that both Yakson Stimulation and Multisensory Stimulation effectively enhance neurobehavioral development and weight gain in preterm infants. The key findings include:

- Yakson Stimulation showed a slightly greater impact on weight gain, suggesting its effectiveness in promoting metabolic efficiency and relaxation.
- Both techniques were equally effective in improving neurobehavioral responses, indicating that structured tactile stimulation can support neurological development in preterm infants.

The results reinforce the importance of touch-based interventions as a cost-effective and non-pharmacological approach to improving neonatal care. Given its effectiveness, Yakson Stimulation can be considered a preferred intervention for weight gain, while both techniques remain valuable for neurodevelopmental support.

### *Future Work*

Future studies would do well to overcome the deficiencies of this work by performing larger, multi-site trials to support more generalizable results. Use of more advanced neuroimaging methods, for example, functional MRI or near-infrared spectroscopy, would be able to yield more meaningful insights into neural mechanisms affected by Yakson Stimulation and Multisensory Stimulation. In addition, long-term follow-up studies following the developmental outcome of infants across several years would be useful in identifying the long-term effects of these interventions. Future research could also involve incorporating biochemical measurements, e.g., levels of stress hormones (cortisol and oxytocin), to further identify the underlying physiological mechanisms responsible for the reported benefits. Furthermore, examining the influence of parental participation and psychological factors on the effectiveness of the interventions could provide a more complete understanding. Lastly, investigating the use of Yakson and Multisensory Stimulation in preterm babies with different medical

conditions, like respiratory distress syndrome or neonatal sepsis, might widen the clinical application of these interventions.

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